Federal Democratic Republic of Ethiopia

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ET 695 (2001) (English): Barley Malt - Determination of Wort Color B

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Foreword

This Ethiopian Standard has been prepared under the direction of the Technical Committee for Cereals, pulses and derived products (TC 11) and published by the Ethiopian Standards Agency (ESA).

The standard is a reaffirmation for reprint of the Ethiopian Standard ES 659:2001, Barley - Determination of wort color by spectrophotometer, with some editorial changes without altering the technical contents in the former text.

Barley malt — Determination of wort color by spectrophotometer

1 Scope

This Ethiopian Standard specifies the method for the determination of wort color by spectrophotometer.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Ethiopian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Ethiopian Standard are encouraged to investigate the possibility of applying the most recent editions of the Ethiopian Standards indicated below. Registers of currently valid standards are maintained in the Quality and Standards Authority of Ethiopia.

ES 6644:2001, *Cereals and milled cereal products-Automatic sampling by mechanical means.*

ES 13960:2001, *Cereals, pulses and milled products – Sampling of static batches.*

3 Reagents

During the analysis, use only reagents of recognized analytical grade reagent and distilled water of equivalent purity.

a) 0.01 N iodine solution – it shall be prepared by dissolving 0.63 g of iodine and 1.25 g of potassium iodine in water and diluted to 500 ml

b) 0.02 N iodine solution – It shall be prepared by dissolving 1.27 g of iodine and 2.50 g of potassium iodine in water and diluted in 500 ml. Both these iodine solutions shall be kept in dark and prepared fresh once a month.

4 Apparatus

Ordinary laboratory apparatus and in particular the following

a) Grinding mills, Miag –Seck type-for fine grinding, the cone type, 300 revolutions per minutes per minute shall be used and for coarse grinding, the role type, 150 revolutions per minute shall be used.

b) Mash beakers and counter weights made of either pure nickel, stainless steel or brass and of such dimension as to assure fight connection between beakers and grinding mill. If counter weights are used for mach beakers, their tare shall be checked frequently.

c) Mashing apparatus – the beakers, stirrers and solders used shall be of he same metal.

d) Gypsum plate

e) Filter paper – Whatman No. 1 or equivalent.

f) Funners –short stem glass funnes having approximately a diameter of 20 cm

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g) Flasks – Erelenmeyers of 500 ml capacity

h) Mill for standard coarse grind: The mill to be used is the European Brewery Convention (EBC) type. Mill filtered with the sieve with circular holes of 2.5 m ± 0.07 mm in diameter

i) Balance accurate to 0.1 g under a load of 750 g.

j) Resichauer type pycnometer which is graduated to contain 50,000 of pure water at 20.00 ^{o}C with the following dimension

Total height: 140 to 160 mm

Length on neck: of 65 to 85 mm

Internal neck diameter: up 2.5 to 4.0

Distance form calibration mark to the top tip 25 to 35 mm

k) Water bath at 20.00 ^{O}C ± 0.05 ^{o}C

l) Analysis balance accurate to 1 mg.

5 Sampling

Sampling shall be carried out in accordance with ES ISO 13960 or ES ISO 6644.

6 Procedure

6.1 Grinding

6.1.1 Coarse grind

A preliminary portion of malt is ground in the EBC mill using the 2.5 mm sieve white tapping on the lower funnel by means of leather hammer. The malt is discarded. Duplicate quantities of 51 g of malt are weighed out and, without opening or brushing out the mill, each portion is ground while each time tapping the funnel. A small portion of each subsequent malt sample is ground and discarded in the same way after which the main portion is ground without opening or brushing out the mill. At the end of the series the mill is opened, brushed out and the brushing discarded. Each grist is well mixed with a spoon and immediately brought to a weight of 50.0g. The mashing process is carried out as for the fine grind.

6.1.2 Fine grinding

Approximately 55 g of sample shall be weighed at room temperature and ground through mill se t for standardized fineness of grind. The finely ground malt shall be collected in the mash beaker carefully brushing malt particle remaining in the mill into the mash beaker. It shall be mixed, without delay the mash beaker with contents placed on balance accurate to within 0.06 g under 750 g load and the mass of the malt adjusted to 50.00 0.05 g by removing excess into tared dish for moisture determination.

6.2 Mashing procedure

Mash in a ground malt with 200 ml portion of distilled water and mix well with glass rod or with metal stirrer so as to avoid clumping. The rode must afterwards be rinsed clean with a small quantity of distilled water. The beaker is immediately placed in the mash bath, which must already be at a temperature of 45^{o}C and the stirred are set in motion. The temperature of 45^{o}C in the mash is maintained for exactly 30 minutes. Then the temperature of the mash is raised 1^{o}C a minute for 25 minute. At this time (when the temperature is 70^{o}C) a further 100 ml of water at 70^{o}C is added. From the point the saccharification rate is measured. The temperature is maintained for one hour and then the mashes are cooled to room temperature in 10-15 minutes.

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The stirrers are washed off, the outsides of the beakers dried and the contents made to a weight of 450.og. The contents of the beakers are thoroughly stirred with a glass rod and each immediately and completely emptied on to a filter, as specified. The filter paper must no project over the edge of the funnel. The first 100 ml of the filtrate is returned to the funnel. The portion for color measurements is taken as soon as possible after this and returned after measurement. Filtration is discontinued when the cake appears dry, or, with slow filtration, after two hours. Immediately before filling the pycnometer the contents of the filtrate flash are well mixed.

6.3 Determination of the specific gravity of wort (the ratio of the weight of a volume of liquid at 20^{O}C to the weight of the same volume of water at the same temperature.

A thoroughly cleaned pycnometer of the type specified in washed out with two lots of about 10 ml of wort. It is then filled with wort and placed in the bath at 20^{o}C (0.05^{o}C) and allowed to stand for half an hour, with the after above the pycnometer calibration mark. After 25 minutes the wort is removed to the mark, and, after a further minutes is adjusted exactly to the mark. The pycnometer is removed form the bath, the outside is dried and it is allowed to stand for about 5 minutes and then weighed and the specified gravity calculated to five places of decimals. If the duplicate determination give specified gravities which differ by more than two units in the fourth decimals place the analysis must be repeated.

6.3 Determination of yield extract between fine and coarse grind

The malt shall be grounded according to clause 6 here in such a manner that the coarse ground malt is retained between 74 and 76% by mass on 300 micron aperture sieve size.

6.4 Determination of pH of the wort

The yield of extract is influenced by the pH of the mash; which as a result need to be measured by a glass electrode. The pH meter shall be checked before and after the used against standard potassium acid phthalate.

7 Expression of result

7.1 The extract content of the wort shall be determined by reference to specified gravity values of the official sugar table (plato table) at 20OC attached herein.

The extract is calculated as follows:

$$E = \frac{P\,(m+800)}{100-p} \quad E' = \frac{E \times 100}{100-M}$$

Where,

E is the extract on the sample

E’ is the extract on the dry malt

P is the grams of extract from 100 grams of wort (plato table)

M is the percent f moisture content in the malt

7.2 Extract difference (between fine and coarse grind) shall be determined separately and the difference in yield expressed in the percent as follows:

Extract difference	Modification
Under 1.3%	Very full
1.3 – 1.9%	Full
2.0 – 2.6%	Normal
2.7 – 3.3 %	Low
Over 3.3%	Very low

7.3 The pH of wort is measured by a glass electrode and is recorded accordingly for each malt.

8 Test result

The test report shall include the following information:

a) reference to this standard ;

b) the results and method of expression used, and all information necessary for complete identification of the sample ; and

c) any unusual features noted during determination.

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT

Table 1

SPECIFIC GRAVITY AT 20/20^{O}C (1)	**GRAMS EXTRACT IN 100 g SOLUTION** (2)	**SPECIFIC GRAVITY AT 20/20^{O}** (1)	**GRAMS EXTRACT IN 100 g SOLUTION** (2)
1.000 00	0.000	1.001 50	0.386
05	0.013	55	0.398
10	0.026	60	0.411
15	0.039	65	0.424
20	0.052	70	4.437
25	0.064	75	0.450
30	0.077	80	0.463
35	0.090	85	0.476
40	0.103	90	0.488
45	0.116	95	0.501
1.000 50	0.129	1.002 00	0.514
55	0.141	05	0.527
60	0.154	10	0.540
65	0.167	15	0.552
70	0.180	20	0.565
75	0.193	25	0.578
80	0.206	30	0.591
85	0.219	35	0.604
90	0.231	40	0.616
95	0.244	45	0.629
1.001 00	0.257	1.002 50	0.642
05	0.270	55	0.655
10	0.283	60	0.668
15	0.296	65	0.680
20	0.309	70	0.693
25	0.321	75	0.706
30	0.334	80	0.719
35	0.347	85	0.732
40	0.360	90	0.745
45	0.373	95	0.757

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT_ *contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.003 00	0.770	1.005 00	1.283
05	0.783	05	1.296
10	0.796	10	1.308
15	0.808	15	1.321
20	0.821	20	1.334
25	0.834	25	1.347
30	0.847	30	1.360
35	0.859	35	1.372
40	0.872	40	1.385
45	0.885	45	1.398
1.003 50	0.898	1.005 50	1.411
55	0.911	55	1.424
60	0.924	60	1.437
65	0.937	65	1.450
70	0.949	70	1.462
75	0.962	75	1.475
80	0.975	80	1.488
85	0.988	85	1.501
90	1.001	90	1.514
95	1.014	95	1.526
1.004 00	1.026	1.006 50	1.539
05	1.039	05	1.552
10	1.052	10	1.565
15	1.065	15	1.578
20	1.078	20	1.590
25	1.090	25	1.603
30	1.103	30	1.616
35	1.116	35	1.629
40	1.129	40	1.641
45	1.142	45	1.654
1.005 00	1.155	1.006 50	1.667
55	1.168	55	1.680
60	1.180	60	1.693
65	1.193	65	1.705
70	1.206	70	1.718
75	1.219	75	1.731
80	1.232	80	1.744
85	1.244	85	1.757
90	1.257	90	1.769
95	1.270	95	1.782

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT_ *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.007 00	1.795	1.009 00	2.305
05	1.807	05	2.317
10	1.820	10	2.330
15	1.833	15	2.343
20	1.846	20	2.356
25	1.859	25	2.369
30	1.872	30	2.381
35	1.884	35	2.394
40	1.897	40	2.407
45	1.910	45	2.419
1.007 50	1.923	1.009 50	2.432
55	1.935	55	2.445
60	1.948	60	2.458
65	1.961	65	2.470
70	1.973	70	2.483
75	1.986	75	2.496
80	1.999	80	2.508
85	1.012	85	2.521
90	1.025	90	2.534
95	1.038	95	2.547
1.008 00	2.053	1.010 00	2.560
05	2.065	05	2.572
10	2.070	10	2.585
15	2.091	15	2.598
20	2.101	20	2.610
25	2.114	25	2.623
30	2.127	30	2.636
35	2.139	35	2.649
40	2.152	40	2.661
45	2.165	45	2.674
1.008 50	2.178	1.010 50	2.687
55	2.191	55	2.699
60	2.203	60	2.712
65	2.216	65	2.725
70	2.229	70	2.738
75	2.241	75	2.750
80	2.254	80	2.763
85	2.267	85	2.776
90	2.280	90	2.778
95	2.292	95	2.801

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT $20/20^{O}$C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT $20/20^{O}$ (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.011 00	2.814	1.013 00	3.321
05	2.826	05	3.333
10	2.839	10	3.346
15	2.852	15	3.358
20	2.864	20	3.371
25	8.877	25	3.384
30	2.890	30	3.396
35	3.903	35	3.409
40	3.915	40	3.421
45	3.928	45	3.434
1.011 50	2.940	1.013 50	3.447
55	2.953	55	3.459
60	2.966	60	3.472
65	2.979	65	3.485
70	2.991	70	3.497
75	2.004	75	3.510
80	2.017	80	3.523
85	2.029	85	3.535
90	2.042	90	3.548
95	2.055	95	3.561
1.012 00	3.067	1.014 00	3.573
05	3.080	05	3.586
10	3.093	10	3.598
15	3.105	15	3.611
20	3.118	20	3.624
25	3.131	25	3.636
30	3.143	30	3.649
35	3.156	35	3.662
40	3.169	40	3.674
45	3.181	45	3.687
1.012 50	3.194	1.014 50	3.699
55	3.207	55	3.712
60	3.219	60	3.725
65	3.232	65	3.737
70	3.245	70	3.750
75	3.257	75	3.762
80	3.270	80	3.775
85	3.282	85	3.788
90	3.295	90	3.800
95	3.308	95	3.813

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.015 00	3.826	1.017 00	4.329
05	3.838	05	4.341
10	3.851	10	4.354
15	3.863	15	4.366
20	3.876	20	4.379
25	3.888	25	4.391
30	3.901	30	4.404
35	3.914	35	4.417
40	3.926	40	4.429
45	3.939	45	4.442
1.015 50	3.951	1.017 50	4.454
55	3.964	55	4.467
60	3.977	60	4.479
65	3.989	65	4.492
70	3.002	70	4.505
75	3.014	75	4.517
80	3.027	80	4.529
85	3.039	85	4.542
90	3.052	90	4.555
95	3.065	95	4.567
1.016 00	4.077	1.018 00	4.580
05	4.090	05	4.592
10	4.102	10	4.605
15	4.115	15	4.617
20	4.128	20	4.630
25	4.140	25	4.642
30	4.153	30	4.655
35	4.165	35	4.668
40	4.178	40	4.680
45	4.190	45	4.692
1.016 50	4.203	1.018 50	4.705
55	4.216	55	4.718
60	4.228	60	4.730
65	4.241	65	4.743
70	4.253	70	4.755
75	4.266	75	4.768
80	4.278	80	4.780
85	4.291	85	4.792
90	4.304	90	4.805
95	4.316	95	4.818

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.019 00	4.830	1.021 00	5.330
05	4.843	05	5.343
10	4.855	10	5.355
15	4.868	15	5.367
20	4.880	20	5.380
25	4.893	25	5.392
30	4.905	30	5.405
35	4.918	35	5.418
40	4.930	40	5.430
45	4.943	45	5.443
1.019 50	4.955	1.021 50	5.455
55	4.968	55	5.467
60	4.980	60	5.480
65	4.993	65	5.492
70	4.006	70	5.505
75	4.018	75	5.517
80	4.030	80	5.530
85	4.043	85	5.542
90	4.055	90	5.555
95	4.068	95	5.567
1.020 00	5.080	1.022 00	5.580
05	5.093	05	5.592
10	5.106	10	5.605
15	5.118	15	5.617
20	5.130	20	5.629
25	5.143	25	5.642
30	5.155	30	5.654
35	5.168	35	5.667
40	5.180	40	5.679
45	5.193	45	5.692
1.020 50	5.205	1.022 50	5.704
55	5.218	55	5.716
60	5.230	60	5.729
65	5.243	65	5.741
70	5.255	70	5.754
75	5.268	75	5.766
80	5.280	80	5.779
85	5.293	85	5.791
90	5.305	90	5.803
95	5.318	95	5.816

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20^{O}C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20^{O} (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.023 00	5.828	1.025 00	6.325
05	5.841	05	6.337
10	5.853	10	6.350
15	5.865	15	6.362
20	5.878	20	6.374
25	5.890	25	6.387
30	5.903	30	6.399
35	5.915	35	6.411
40	5.928	40	6.424
45	5.940	45	6.436
1.023 50	5.952	1.025 50	6.449
55	5.965	55	6.461
60	5.977	60	6.473
65	5.990	65	6.485
70	6.002	70	6.498
75	6.015	75	6.510
80	6.027	80	6.523
85	6.039	85	6.535
90	6.052	90	6.547
95	6.064	95	6.560
1.024 00	6.077	1.026 00	6.572
05	6.089	05	6.584
10	6.101	10	6.597
15	6.114	15	6.609
20	6.126	20	6.621
25	6.139	25	6.634
30	6.151	30	6.646
35	6.163	35	6.659
40	6.176	40	6.671
45	6.188	45	6.683
1.024 50	6.200	1.026 50	6.696
55	6.213	55	6.708
60	6.225	60	6.720
65	6.238	65	6.733
70	6.250	70	6.745
75	6.263	75	6.757
80	6.275	80	6.770
85	6.287	85	6.782
90	6.300	90	6.794
95	6.312	95	6.807

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20^{O}C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20^{O} (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.027 00	6.819	1.029 00	7.312
05	6.831	05	7.324
10	6.844	10	7.337
15	6.856	15	7.349
20	6.868	20	7.361
25	6.881	25	7.374
30	6.893	30	7.386
35	6.905	35	7.398
40	6.918	40	7.411
45	6.930	45	7.423
1.027 50	6.943	1.029 50	7.435
55	6.955	55	7.447
60	6.967	60	7.460
65	6.979	65	7.472
70	6.992	70	7.484
75	7.004	75	7.497
80	7.017	80	7.509
85	7.029	85	7.521
90	7.041	90	7.533
95	7.053	95	7.546
1.028 00	0.666	1.030 00	7.558
05	7.078	05	7.570
10	7.091	10	7.583
15	7.103	15	7.595
20	7.115	20	7.607
25	7.127	25	7.619
30	7.140	30	7.632
35	7.152	35	7.644
40	7.164	40	7.656
45	7.177	45	7.668
1.028 50	7.189	1.030 50	7.681
55	7.201	55	7.693
60	7.214	60	7.705
65	7.226	65	7.717
70	7.238	70	7.730
75	7.251	75	7.742
80	7.263	80	7.754
85	7.275	85	7.767
90	7.287	90	7.779
95	7.300	95	7.791

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	**GRAMS EXTRACT IN 100 g SOLUTION** (2)	**SPECIFIC GRAVITY AT 20/20°** (1)	**GRAMS EXTRACT IN 100 g SOLUTION** (2)
1.031 00	7.803	1.033 00	8.293
05	7.816	05	8.305
10	7.828	10	8.317
15	7.840	15	8.330
20	7.853	20	8.342
25	7.865	25	8.354
30	7.877	30	8.366
35	7.889	35	8.378
40	7.901	40	8.391
45	7.914	45	8.403
1.031 50	7.926	1.033 50	8.415
55	7.938	55	8.427
60	7.950	60	8.439
65	7.963	65	8.452
70	7.975	70	8.464
75	7.987	75	8.476
80	8.000	80	8.488
85	8.012	85	8.500
90	8.024	90	8.513
95	8.036	95	8.525
1.032 00	8.048	1.034 00	8.537
05	8.061	05	8.549
10	8.073	10	8.561
15	8.085	15	8.574
20	8.098	20	8.586
25	8.110	25	8.598
30	8.122	30	8.610
35	8.134	35	8.622
40	8.146	40	8.634
45	8.159	45	8.647
1.032 50	8.171	1.034 50	8.659
55	8.183	55	8.671
60	8.195	60	8.683
65	8.207	65	8.695
70	8.220	70	8.708
75	8.232	75	8.720
80	8.244	80	8.732
85	8.256	85	8.744
90	8.269	90	8.756
95	8.281	95	8.768

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.035 00	8.781	1.037 00	9.267
05	8.793	05	9.279
10	8.805	10	9.291
15	8.817	15	9.303
20	8.830	20	9.316
25	8.842	25	9.328
30	8.854	30	9.340
35	8.866	35	9.352
40	8.878	40	9.364
45	8.890	45	9.376
1.035 50	8.902	1.037 50	9.388
55	8.915	55	9.400
60	8.927	60	9.413
65	8.939	65	9.425
70	8.951	70	9.437
75	8.963	75	9.449
80	8.975	80	9.461
85	8.988	85	9.473
90	9.000	90	9.785
95	9.012	95	9.498
1.036 00	9.024	1.038 00	9.509
05	9.036	05	9.522
10	9.048	10	9.534
15	9.060	15	9.546
20	9.073	20	9.558
25	9.085	25	9.570
30	9.097	30	9.582
35	9.109	35	9.594
40	9.121	40	9.606
45	9.133	45	9.618
1.036 50	9.145	1.038 50	9.631
55	9.158	55	9.643
60	9.170	60	9.655
65	9.182	65	9.667
70	9.194	70	9.679
75	9.206	75	9.691
80	9.218	80	9.703
85	9.230	85	9.715
90	9.243	90	9.727
95	9.255	95	9.740

(Continued)

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20^{O}C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20^{O} (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.039 00	9.751	1.041 00	10.234
05	9.764	05	10.246
10	9.776	10	10.259
15	9.788	15	10.271
20	9.800	20	10.283
25	9.812	25	10.295
30	9.824	30	10.307
35	9.836	35	10.319
40	9.848	40	10.331
45	9.860	45	10.343
1.039 50	9.873	1.041 50	10.355
55	9.885	55	10.367
60	9.897	60	10.379
65	9.909	65	10.391
70	9.921	70	10.403
75	9.933	75	10.415
80	9.945	80	10.427
85	9.957	85	10.439
90	9.969	90	10.451
95	9.981	95	10.463
1.040 00	9.903	1.042 00	10.475
05	10.005	05	10.487
10	10.017	10	10.499
15	10.030	15	10.511
20	10.042	20	10.523
25	10.054	25	10.536
30	10.066	30	10.548
35	10.078	35	10.559
40	10.090	40	10.571
45	10.102	45	10.584
1.040 50	10.114	1.042 50	10.596
55	10.126	55	10.608
60	10.138	60	10.620
65	10.150	65	10.632
70	10.162	70	10.644
75	10.174	75	10.656
80	10.186	80	10.668
85	10.198	85	10.680
90	10.210	90	10.692
95	10.223	95	10.704

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.043 00	10.716	1.045 00	11.195
05	10.728	05	11.207
10	10.740	10	11.219
15	10.752	15	11.231
20	10.764	20	11.243
25	10.776	25	11.255
30	10.788	30	11.267
35	10.800	35	11.279
40	10.812	40	11.291
45	10.824	45	11.303
1.043 50	10.836	1.045 50	11.315
55	10.848	55	11.327
60	10.860	60	11.339
65	10.872	65	11.351
70	10.884	70	11.363
75	10.896	75	11.375
80	10.908	80	11.387
85	10.920	85	11.399
90	10.932	90	11.411
95	10.944	95	11.423
1.044 00	10.956	1.046 00	11.435
05	10.968	05	11.446
10	10.980	10	11.458
15	10.992	15	11.470
20	11.004	20	11.482
25	11.016	25	11.494
30	11.027	30	11.506
35	11.039	35	11.518
40	11.051	40	11.530
45	11.063	45	11.542
1.044 50	11.075	1.046 50	11.554
55	11.087	55	11.566
60	11.100	60	11.578
65	11.112	65	11.590
70	11.123	70	11.602
75	11.135	75	11.614
80	11.147	80	11.626
85	11.159	85	11.638
90	11.171	90	11.650
95	11.183	95	11.661

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20^{O}C (1)	**GRAMS EXTRACT IN 100 g SOLUTION** (2)	**SPECIFIC GRAVITY AT 20/20^{O}** (1)	**GRAMS EXTRACT IN 100 g SOLUTION** (2)
1.047 00	11.673	1.049 00	12.150
05	11.685	05	12.162
10	11.697	10	12.173
15	11.709	15	12.185
20	11.721	20	12.197
25	11.733	25	12.209
30	11.745	30	12.221
35	11.757	35	12.233
40	11.768	40	12.245
45	11.780	45	12.256
1.047 50	11.792	1.049 50	12.268
55	11.804	55	12.280
60	11.816	60	12.292
65	11.828	65	12.304
70	11.842	70	12.316
75	11.852	75	12.328
80	11.864	80	12.340
85	11.876	85	12.351
90	11.888	90	12.363
95	11.900	95	12.375
1.048 00	11.912	1.050 00	12.387
05	11.923	05	12.399
10	11.935	10	12.411
15	11.947	15	12.423
20	11.959	20	12.435
25	11.971	25	12.447
30	11.983	30	12.458
35	11.995	35	12.470
40	12.007	40	12.482
45	12.019	45	12.494
1.048 50	12.031	1.050 50	12.506
55	12.042	55	12.518
60	12.054	60	12.530
65	12.066	65	12.542
70	12.078	70	12.553
75	12.090	75	12.565
80	12.102	80	12.577
85	12.114	85	12.589
90	12.126	90	12.601
95	12.138	95	12.613

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.051 00	12.624	1.053 00	13.098
05	12.636	05	13.109
10	12.648	10	13.121
15	12.660	15	13.133
20	12.672	20	13.145
25	12.684	25	13.157
30	12.695	30	13.168
35	12.707	35	13.180
40	12.719	40	13.192
45	12.731	45	13.204
1.051 50	12.743	1.053 50	13.215
55	12.755	55	13.227
60	12.767	60	13.239
65	12.778	65	13.251
70	12.790	70	13.263
75	12.802	75	13.274
80	12.814	80	13.286
85	12.826	85	13.298
90	12.838	90	13.310
95	12.849	95	13.322
1.052 00	12.861	1.054 00	13.333
05	12.873	05	13.345
10	12.885	10	13.357
15	12.897	15	13.369
20	12.909	20	13.380
25	12.920	25	13.392
30	12.932	30	13.404
35	12.944	35	13.416
40	12.956	40	13.428
45	12.968	45	13.439
1.052 50	12.979	1.054 50	13.451
55	12.991	55	13.463
60	13.003	60	13.475
65	13.015	65	13.487
70	13.027	70	13.499
75	13.039	75	13.510
80	13.050	80	13.522
85	13.062	85	13.534
90	13.074	90	13.546
95	13.086	95	13.557

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.055 00	13.569	1.057 00	14.039
05	13.581	05	14.051
10	13.593	10	14.062
15	13.604	15	14.074
20	13.616	20	14.086
25	13.628	25	14.097
30	13.640	30	14.109
35	13.651	35	14.121
40	13.663	40	14.133
45	13.675	45	14.144
1.055 50	13.687	1.057 50	14.156
55	13.698	55	14.168
60	13.710	60	14.179
65	13.722	65	14.191
70	13.734	70	14.203
75	13.746	75	14.215
80	13.757	80	14.226
85	13.769	85	14.238
90	13.781	90	14.250
95	13.792	95	14.261
1.056 00	13.804	1.058 00	14.273
05	13.816	05	14.285
10	13.828	10	14.297
15	13.839	15	14.308
20	13.851	20	14.320
25	13.863	25	14.332
30	13.875	30	14.343
35	13.886	35	14.355
40	13.898	40	14.367
45	13.910	45	14.379
1.056 50	13.921	1.058 50	14.390
55	13.933	55	14.402
60	13.945	60	14.414
65	13.957	65	14.425
70	13.968	70	14.437
75	13.980	75	14.449
80	13.992	80	14.460
85	14.004	85	14.472
90	14.015	90	14.484
95	14.027	95	14.495

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.059 00	14.507	1.061 00	14.974
05	14.519	05	14.986
10	14.531	10	14.997
15	14.542	15	15.009
20	14.554	20	15.020
25	14.565	25	15.032
30	14.577	30	15.044
35	14.589	35	15.055
40	14.601	40	15.067
45	14.612	45	15.079
1.059 50	14.624	1.061 50	15.090
55	14.636	55	15.102
60	14.647	60	15.114
65	14.659	65	15.125
70	14.671	70	15.137
75	14.682	75	15.148
80	14.694	80	15.160
85	14.706	85	15.172
90	14.717	90	15.183
95	14.729	95	15.195
1.060 00	14.741	1.062 00	15.207
05	14.752	05	15.218
10	14.764	10	15.230
15	14.776	15	15.241
20	14.787	20	15.253
25	14.799	25	15.265
30	14.811	30	15.276
35	14.822	35	15.288
40	14.834	40	15.300
45	14.846	45	15.311
1.060 50	14.857	1.062 50	15.323
55	14.869	55	15.334
60	14.881	60	15.346
65	14.892	65	15.358
70	14.904	70	15.369
75	14.916	75	15.381
80	14.927	80	15.393
85	14.939	85	15.404
90	14.950	90	15.416
95	14.962	95	15.427

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SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.063 00	15.439	1.065 00	15.903
05	15.451	05	15.914
10	15.462	10	15.926
15	15.474	15	15.938
20	15.486	20	15.949
25	15.497	25	15.961
30	15.509	30	15.972
35	15.520	35	15.984
40	15.532	40	15.995
45	15.544	45	16.007
1.063 50	15.555	1.065 50	16.019
55	15.567	55	16.030
60	15.578	60	16.041
65	15.590	65	16.053
70	15.602	70	16.065
75	15.613	75	16.076
80	15.625	80	16.088
85	15.637	85	16.099
90	15.648	90	16.111
95	15.660	95	16.122
1.064 00	15.671	1.066 00	16.134
05	15.683	05	16.145
10	15.694	10	16.157
15	15.706	15	16.169
20	15.717	20	16.180
25	15.729	25	16.191
30	15.741	30	16.203
35	15.752	35	16.215
40	15.764	40	16.226
45	15.776	45	16.238
1.064 50	15.787	1.066 50	16.249
55	15.799	55	16.261
60	15.810	60	16.272
65	15.822	65	16.284
70	15.833	70	16.295
75	15.845	75	16.307
80	15.857	80	16.319
85	15.868	85	16.330
90	15.880	90	16.341
95	15.891	95	16.353

(Continued)

SPECIFIC GRAVITY AND DEGREES PLATO OF SUGAR SOLUTIONS OR PERCENT EXTRACT BY WEIGHT – *Contd.*

SPECIFIC GRAVITY AT 20/20°C (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)	SPECIFIC GRAVITY AT 20/20° (1)	GRAMS EXTRACT IN 100 g SOLUTION (2)
1.067 00	16.365	1.068 50	16.710
05	16.376	55	16.722
10	16.388	60	16.733
15	16.399	65	16.744
20	16.411	70	16.756
25	16.422	75	16.768
30	16.434	80	16.779
35	16.445	85	16.791
40	16.457	90	16.802
45	16.468	95	16.813
1.0067 50	16.480	1.069 00	16.825
55	16.491	05	16.836
60	16.503	10	16.848
65	16.514	15	16.859
70	16.526	20	16.871
75	16.537	25	16.882
80	16.549	30	16.894
85	16.561	35	16.905
90	16.572	40	16.917
95	16.583	45	16.928
1.068 00	16.595	1.0069 50	16.940
05	16.606	55	16.951
10	16.618	60	16.963
15	16.630	65	16.974
20	16.641	70	16.986
25	16.652	75	16.997
30	16.664	80	17.009
35	16.676	85	17.020
40	16.687	90	17.032
45	16.699	95	17.043

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Ethiopian Standards Agency

Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010.ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1970.

ESA's objectives are:-

- Develop Ethiopian standards and establish a system that enable to check weather goods and services are in compliance with the required standards,
- Facilitate the country's technology transfer through the use of standards,
- Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/ or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.
Orders for all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

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More Information?
Contact us at the following address.
The Head Office of ESA is at Addis Ababa.

☎ 011- 646 06 85, 011- 646 05 65
📠 011-646 08 80
✉ 2310 Addis Ababa, Ethiopia
E-mail: info@ethiostandards.org,
Website: www.ethiostandards.org

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